Improving the effectiveness of UK crop genetic science for wheat and oilseed rape through novel, integrated networks of research

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Rothamsted Research

15th March 2006
The Defra Crop Genetic Improvement Networks
Announced July 2002

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Arable Crop Sciences & Pesticide Safety Unit
Science Directorate
Defra
Overall Objectives

• Each Crop Genetic Improvement Network = Virtual Plant Breeding Institute

• To use crop breeding for the **sustainable development of the arable sector**

• To connect public sector science to the private sector

Why this need?
A brief history of UK public and private sector activities in crop genetics

1960s – Plant Breeders Rights established
- competition till mid-1980s

Transfer of information only, not breeding material


In mid-1980s, privatisation – sale of PBI and NSDO Public Research Institute’s to generate revenue from non-government sources and from own IP
Where was Defra coming from?

- Public research - £43 m pa
  - £16 m on named crop species
  - £5 m on targeted research
  - Little use of LINK
  - Project based
  - Pre-competitive

- Public R&D is only effective in supporting Defra if it results in better varieties
The Defra Crop Genetic Improvement Networks

To recreate the best of the past

To deploy existing research resources in networks of projects that bring public resources together to bear on the improvement of key crops

Strategic alliances between the public research base and the breeding industry
Networks established

• Wheat
• Oilseed rape
• Short rotation coppice
‘GIN network structure

- Stakeholder forum
- Breeders
- Satellite projects
- Defra CORE project
- LINK projects
- EU projects
- BBSRC
The longer-term vision

• A strong crop breeding sector deploying the best technologies science can offer

• A strong strategic and applied research base competing effectively for resources

• A strong base for international partnerships

• More resource efficient and productive crops
The Defra WGIN Core Project

Aims:
To Underpin Wheat Improvement by Plant Breeders

Approaches:
1. Characterisation and provision of genetic resources
2. Genetic mapping and marker development
3. Trait identification
4. Identification and generation of novel variation in key traits: using non-GM approaches
5. Central storage of grain from field trials
6. Liaison and communication

Funded research partners:
Rothamsted Research and John Innes Centre
## WGIN Traits Meeting
### June 10th, 2004 at RRes

<table>
<thead>
<tr>
<th>Breeders’ target traits (in order of priority):</th>
<th>Progress (Feb 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hagberg Falling Number</td>
<td>LINK project funded £2.2M (2005)</td>
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<tr>
<td>Septoria resistance</td>
<td>LINK project renewed</td>
</tr>
<tr>
<td>Second wheat syndrome</td>
<td>LINK concept note accepted (2006)</td>
</tr>
<tr>
<td>Orange blossom midge</td>
<td>LINK project running</td>
</tr>
<tr>
<td>Ergot</td>
<td>LINK project running</td>
</tr>
<tr>
<td>Lodging resistance</td>
<td>Some activity within core project (Rht)</td>
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</tbody>
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Barley Yellow Dwarf Virus
Other insect pests
Nitrogen use efficiency

- Defra target but no breeder support
OREGIN core project

*B. napus* genetic resources (WHRI)

- WP1 Set of germplasm
- WP2 Mapping populations
- WP3 Genetic variation

Genetics of disease resistance (RRes)

- WP4 Pathogen collection/diversity
- WP5 Genetic screening methods

Communication (WP6, WHRI/RRes)
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<tr>
<td>Diseases</td>
<td>- OREGIN Core project + LINK project on sampling</td>
</tr>
<tr>
<td>Insect resistance</td>
<td>- LINK project planned</td>
</tr>
<tr>
<td>Seedling establishment</td>
<td>- LINK project running</td>
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<tr>
<td>Nitrogen use efficiency</td>
<td></td>
</tr>
<tr>
<td>Water utilisation</td>
<td></td>
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<tr>
<td>Crop architecture</td>
<td></td>
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<tr>
<td>Seed quality</td>
<td></td>
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<td>Non-food uses</td>
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WGIN and OREGIN: Resources and Tools

Sources of variation

EMS mutagenised M2 wheat plants
Reference mapping populations
Diploid wheat accessions
Hexaploid wheat genotype collections
*Brassica napus* Diversity Fixed Foundation Set
Brassica mapping populations
*Brassica napus* NILs

Evaluation platforms

Molecular markers (SSR)
TILLING – mining for allele variants
Developing efficient screens/”ascospore shower”
*L. maculans* minisatellites
*L. maculans* NILs
The Management Teams

**WGIN**

**Defra**

**Funded partners.**
- Rothamsted Research
- John Innes Centre

**Other Partners** *
- ADAS
- University of Nottingham
- NIAB
- University of Bristol

**BBSRC***

**UK Wheat breeders***

**HGCA***

(*Ex-Officio Members)

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**OREGIN**

**Defra**

**Funded partners.**
- Rothamsted Research
- Warwick HRI

**Other Partners** *
- JIC
- ADAS
- NIAB

**BBSRC***

**UK OSR breeders***

**HGCA***

(*Ex-Officio Members)
## The Stakeholders

**WGIN**
- Millers and Bakers
- Brewers and Distillers
- CCFRA
- Livestock Feed Producers
- Food processors
- Agrochemical/Biotech Companies
- Wheat Researchers
- Field Trials Contractors
- Wheat Breeders

**OREGIN**
- Crushers
- Livestock Feed Producers
- Food processors
- Biodiesel producers
- Agrochemical/Biotech Companies
- Sponsors (Defra, BBSRC, HGCA)
- OSR Researchers
- OSR Breeders
- Agronomists
- Farmers
The Defra WGIN: Dissemination, Liaison and Communication

Annual “Stakeholders’ Forum” (Nov)
“Cereal Genetics and Genomics Workshop” (Dec 2003)
BBSRC funded annual Small Grain cereals workshop
“Traits Workshops” (June 2004)
Workshops with overseas partner organisations: CIMMYT, INRA etc.
Web Site (www.WIGN.org.UK)
Six Monthly Electronic Newsletter
The Defra OREGIN: Dissemination, Liaison and Communication

Annual “Stakeholders’ Forum” (March)
Annual workshops in conjunction with the UK Brassica Research Community (July)
Workshops with overseas partner organisations: INRA, University of Melbourne, etc.
Web Site (www.OREGIN.info)
Regular emails via the UK BRC distribution list
Representation at HGCA workshops/Cereals/growers events
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